Committee on Earth Observation Satellites
17th Plenary Meeting
Colorado Springs, Colorado
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CEOS/17/CEOP

Item 8

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Coordinated Enhanced Observing Period (CEOP) REPORT

SUMMARY AND PURPOSE

As the first element of the IGOS Water Cycle Theme, CEOP is seeking to develop a pilot global and integrated water cycle dataset with global consistency associated with climate variability by coordinating the in-situ and satellite observations and the numerical weather prediction (NWP) model outputs for the specified periods, the preliminary data period from July to September in 2001, the first annual enhanced observing period from October 2002 to September 2003, and the second one from October 2003 to December 2004.

This report points out that CEOP framework, including the basic strategy for exploitation of satellite data, handling of in-situ data and connections to NWP centers, has been established. This reports describes the development of dataset integration in cooperation between the CEOP data integration institutions and CEOS/WGISS and its preliminary application to validation of satellite hydrology products and evaluation of water cycle processes in global and regional models.

ACTION PROPOSED

The 17th Plenary meeting is recommended to:

- Recognize that CEOP represents a unique opportunity to improve the scientific basis needed to achieve the overall water cycle documentation and prediction goals by co-ordination of EO data gathering, data services and data validation amongst international space agencies and that CEOP is directly relevant to the principal objectives of CEOS.
- Encourage all Members and Associates to make comments and advise as members of the CEOP Advisory and Oversight Committee (AOC).
- Encourage all Members and Associates to support CEOP for assistance with EO satellite sub-setted data inputs.
- Endorse the CEOP reference site data collection activities
- Endorse the CEOP data integration activities in cooperation with CEOS/WGISS.
- Endorse the CEOP Global Land Data Assimilation System (GLDAS) development.
- Endorse the CEOP Water and Energy Simulation and Prediction (WESP)
- Endorse the CEOP Inter-monsoonal Model Study (CIMS)

1. Executive Summary

CEOP is an effort to achieve more accurate determination of the water cycle and its association with climate variability and change as well as to establish a baseline set of information on the impacts of this variability on water resources which was initiated within the International framework of WCRP by the Global Energy and Water Cycle Experiment (GEWEX).

The CEOP preliminary data period, EOP-1, was implemented from July to September in 2001. The first annual enhanced observing period, EOP-3, started on October 1, 2002 and terminated on September 30, 2003. The second one, EOP-4, started on October 1, 2003. CEOP is seeking to achieve a database of common measurements from satellite remote sensing, in-situ, model output, and four-dimensional data analyses (4DDA; including global and regional reanalyzes) for a specified period. In this context, the initial step of CEOP is to develop a pilot global hydro-climatological dataset with global consistency associated with climate variability that can be used to help validate satellite hydrology products and evaluate, develop and eventually predict water and energy cycle processes in global and regional models. The dataset, will be used to address studies on the inter-comparison and inter-connectivity of the monsoon systems and regional water and energy budgets, and will provide means for down-scaling from the global climate to local water resources, as a secondary activity.

CEOP is well underway and that the framework has been established and the basic strategy for exploitation of satellite data, handling of in-situ data and connections to NWP centers is in place. There was an agreement that CEOP is helping to pave the way for current/future global efforts including GEWEX Phase II, CLIVAR, CliC under WCRP and others. It was also noted that CEOP has been accepted by other international units including its endorsement as the first element of the IGOS-P Water Cycle Theme.

2. CEOP Implementation Overview

2.1 CEOP Reference Site Data Management Overview

It was noted that the CEOP Reference Site Data Management process is moving forward, in specific a data policy has been established, a commitment has been obtained from 36 reference sites around the globe to provide data to CEOP in a standardized format. An initial data set has been produced for the period from July to September 2001 (EOP-1) and is being exploited for research purposes.

The CEOP Data Management Working Group (DMWG) developed a prototype “composite” data set from EOP-1, using data from 16 Reference Sites located around the world. This initial data set was produced by obtaining processed data from each Reference Site in “native” diverse formats and file structures. The University Corporation for Atmospheric Research (UCAR) Joint Office for Science Support (JOSS) then produced software to convert the data from each of these Reference Site to a

common format (column ASCII layout, standardized parameters, and uniform time stamp) and applied a final quality assurance review to the final data.

Any resulting problems or issues were interactively solved with the respective data providers. This prototype "composite" data set was delivered to the CEOP Scientific Community in February 2003(see http://www.joss.ucar.edu/ghp/ceopdm/), and evaluated during the CEOP Reference Site Manager's Workshop and the 2nd Implementation Planning Meeting (Berlin, Germany) in March 2003. From discussions at these meetings, a series of modifications were agreed upon for future CEOP Reference Site data sets.

Updates of the inventory and metadata of CEOP Reference Sites continued. A dynamic matrix table is located directly at: http://www.joss.ucar.edu/ghp/ceopdm/rsite.html and summarizes specific information and metadata about the individual Reference Sites (locations, descriptions, maps, site contacts, sample data sets, instrumentation, parameters measured, etc.).

2.2 CEOP Satellite Data Integration Overview

Efforts have been focused on development of a satellite data Integration and visualization center at the University of Tokyo with support from JAXA. This activity has been centered on a 500 terra byte data archiving system. The main issue related to the satellite data integration is a commitment by each space agency to work with CEOP on the provision of EO satellite data in a sub-setted format for each of the 36 current CEOP Reference Site areas in accordance with the CEOP requirement. The background is outlined with respect to the connections and authority established for this commitment by way of CEOS.

The CEOS Working Group on Information Systems and Services (WGISS) Test Facility (WTF) for CEOP has been established by the co-championship of JAXA and NASA. Of special significance is the continued development of the JAXA promoted, WTF-CEOP will provide the means to integrate specific *in situ*, satellite and model data in 250Km x 250Km grid squares centered at each CEOP reference site and to make the data available by means of an Internet server scheme. A prototype of this system is planned to be demonstrated at the 17th CEOS Plenary meeting.

?The value-added Land Data Assimilation products from both regional and global scale processing systems with emphasis on the Global Land Data Assimilation system (GLDAS) are being developed in the USA (NASA/GSFC and NCEP) as a contribution to CEOP that will improve land surface, weather, and climate predictions by providing global fields of land surface energy and moisture stores for initialization. CEOP is specifically interested in the generation and application of GLDAS results in regional climate analysis, model initialization, and comparison with results from field campaigns and modeling experiments. CEOP strongly endorses GLDAS as a critically key contribution to the

successful achievement of the main CEOP analysis goals.

2.3 CEOP Model Output Data Product/Handling Overview

The CEOP Model Output effort is advancing. The initial request for support from major NWP centers has been responded to by 9 such centers and all are committed to contributing both Model Output Location Time Series (MOLTS) at each CEOP reference site and two and three dimensional globally gridded data sets. The model output science issues and strategy are continuing to evolve and are being worked out in regularly scheduled conference calls. The research applications were highlighted during the talk including the initial inter-comparisons being carried out, which apply the EOP-1 data to the results of model runs at the CEOP reference site locations.

The Max Planck Institute (MPI) for Meteorology at Hamburg, Germany, is constructing the CEOP Model Output database from CEOP-model data that are provided by the contributing NWPs and placed on the central file server at MPI. The datasets are stored in the Climate and Environmental Data Retrieval and Archive System (CERA) as time series with information in the form of Meta data descriptions for each independent dataset. Data can be retrieved from the database by an Internet based browser (java applet) once a user account is obtained as noted above. Elements of time series (records) can be downloaded individually, as a sequence of records or as the complete set of records (complete time series). There has been a large commitment on behalf of CEOP by MPI including setting up a gateway to the CEOP Model Output archive. A critical factor in the usability of the database at MPI is the ability of users to access the database in its planned form. MPI has provided a new web-page accessible at MPI that may serve as the interface their database. The URL is http://www.mad.zmaw.de/CEOP.

2.4 CEOP Water and Energy Simulation and Prediction (WESP)

The CEOP WESP is being well underway. A major activities plan has been produced and distributed for comment. An initial inter-comparison exercise has been further developed into a broader application that will contribute to an improved understanding of the ability of models to characterize water and energy cycles in the climate system.

The main issues related to the continued development of WESP including plans to follow through on the Water and Energy Budget Studies (WEBS) already under way in the GEWEX Hydro-meteorology Panel; to focus on Land Data Assimilation issues using 4DDA systems; to address transferability of coupled atmosphere/soil regional models to different CEOP regions around the globe; and to refine the Hydro-climatological Data Requirements in CEOP that identify model processes and state variables that can be compared to *in situ* and satellite measurements as well as each other.

2.5 CEOP Inter-monsoonal Model Study (CIMS) Overview

The Monsoon systems studies working group within CEOP was noted to have taken several important steps toward its successful implementation. CIMS and Validation Project has been defined and endorsed by the CEOP Science Steering Committee. Interfaces between GEWEX and CLIVAR on this topic have been established.

CIMS plans to focus on (a) the roles of diurnal cycle in large-scale heating and circulations, (b) the relative roles and interactions between land/atmosphere/ocean processes in the seasonal cycle and (c) mechanisms of intra-seasonal variations and their roles in the monsoon variability (seasonal cycle and interannual variability). The value of the application of CEOP data is essential to monsoon studies and especially to CIMS.

2.6 Overall CEOP Management and Organizational Structure

The overall management and organization of CEOP was described as established and functioning. An CEOP Secretariat function consists of CEOP International Coordinator, Dr. S. Benedict, and CEOP Implementation Project Office that has been established at the University of Tokyo. The CEOP Science Steering Committee (SSC) has been activated under the Chairmanship of Professor Grassl and a CEOP Advisory and Oversight Committee (AOC) has also begun to emerge under the Co-Chairmanship of Drs Akimas Sumi of JAXA and Jack Kaye of NASA .

The primary outreach activities are being organized by the CEOP Secretariat. It has produced 4 editions of the CEOP Newsletter as well as a CEOP Brochure. In order to save resources, the CEOP Secretariat has negotiated an arrangement to have the CEOP Newsletters distributed through the CEOS Secretariat, and the GEWEX and CLIVAR International Project Offices at the same time they distribute there own Newsletters. This scheme has worked well for CEOP. This group has also supported the involvement of CEOP in the WSSD and WWF meetings and is expected to assist with work related to a CEOP contribution to GEO. There was agreement that the success of CEOP up to now could not have been achieved without the excellent support of this Office.